

# Simpson

INSTRUMENTS THAT STAY ACCURATE

## OPERATOR'S MANUAL

**VOLT-OHM-MILLIAMMETERS  
260<sup>®</sup>, SERIES 5 AND  
260<sup>®</sup>, SERIES 5M**

**SIMPSON ELECTRIC COMPANY**

5200 W. Kinzie St., Chicago, Illinois 60644  
Area Code 312, Telephone 379-1121  
In Canada, Bach-Simpson, Ltd., London, Ontario

# Simpson panel instruments.



4½" RECTANGULAR

1375 STOCK TYPES

... plus HUNDREDS MORE, custom-built  
from standing tools \*

INSTRUMENTS THAT STAY ACCURATE

\* Send us your special meter requirements today. Let our top-flight engineers work out solutions or make recommendations best suited to your needs.

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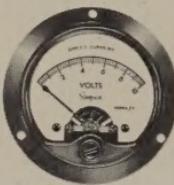
2½" RECTANGULAR  
ACCURACY: ±2%



6" RECTANGULAR  
ACCURACY: ±2%



1½", 2½", 3½", 4½"  
WIDE VUE  
ACCURACY: ±2%



2½" or 3½" ROUND  
ACCURACY: ±2%



EDGEWISE  
ACCURACY: DC ±2%  
SCALE LENGTH: 1 1/8"



ELAPSED TIME  
INDICATOR  
110/220 VOLTS

See the Simpson ADD-A-TESTER ADAPTERS they will increase the versatility of your 260 or 270 VOM'S.

## TRANSISTOR TESTER

Model 650 ..... \$38.00

## DC VTVM

Model 651 ..... \$45.00

## TEMPERATURE TESTER

Model 652 ..... \$43.00

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Model 653 ..... \$26.00

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Model 654 ..... \$28.00

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Model 655 ..... \$26.00

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Model 656 ..... \$26.00

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Model 657 ..... \$48.00

## DC AMMETER

Model 661 ..... \$28.00

# **OPERATOR'S MANUAL**

**VOLT-OHM-MILLIAMMETERS**

**260<sup>(R)</sup> SERIES 5  
AND  
260<sup>(R)</sup> SERIES 5M**

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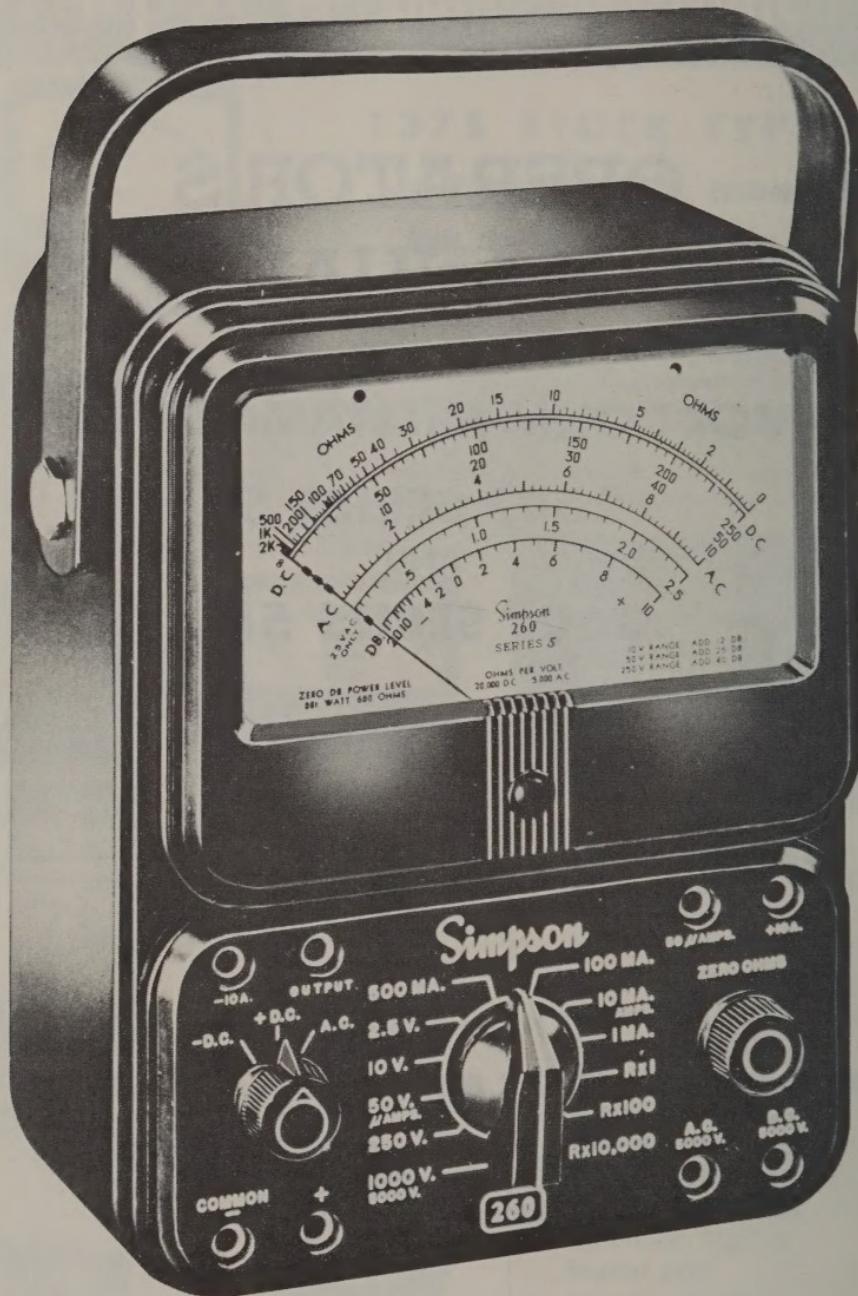


FIG. 1. 260-5® VOLT-OHM-MILLIAMMETER

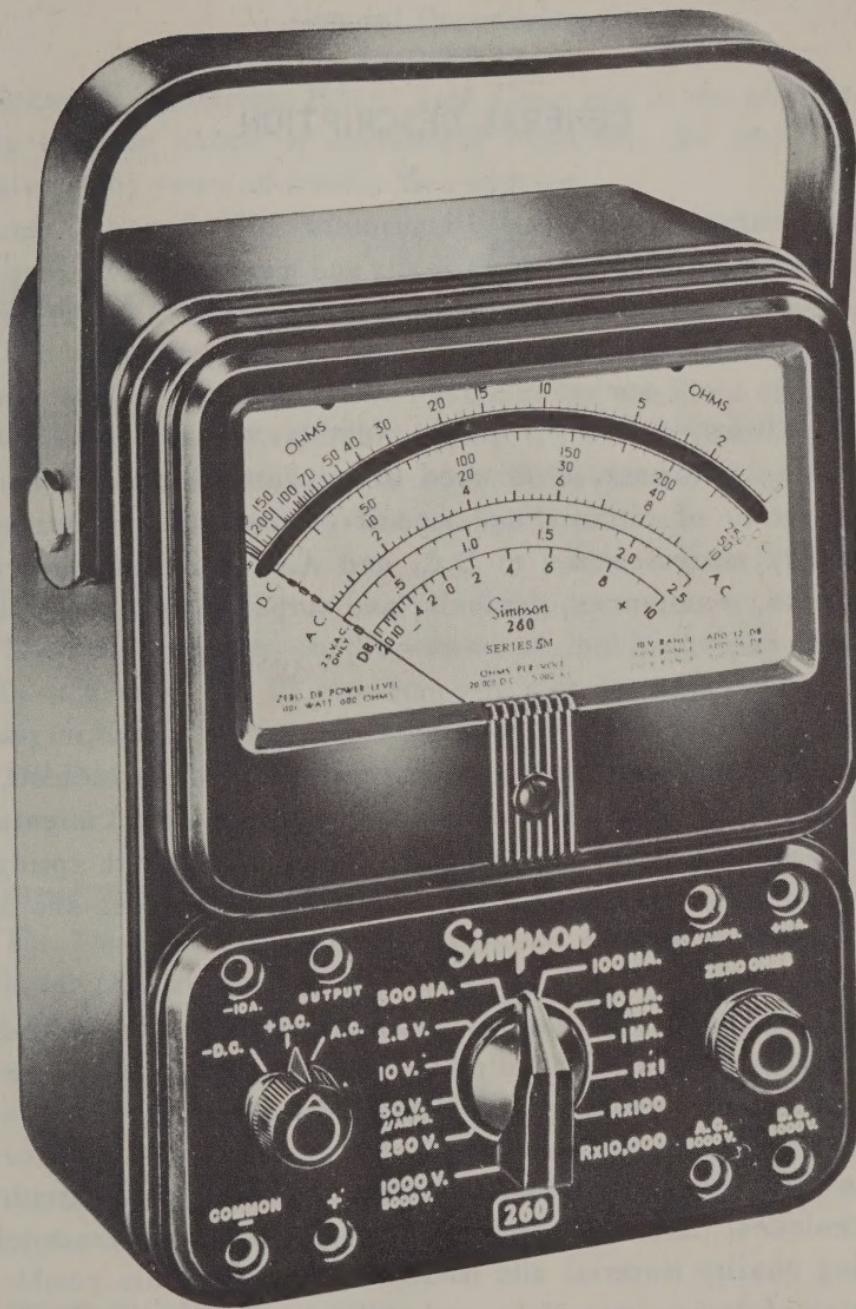


FIG. 2. 260-5M® VOLT-OHM-MILLIAMMETER

## SECTION I

### GENERAL DESCRIPTION

The Simpson Volt-Ohm-Milliammeters 260 Series 5 and Series 5M are identical electrically and mechanically except the Series 5M is equipped with a mirrored dial. Therefore, they are treated as one and the same in this manual.

The 260 Series 5 is a rugged, accurate, compact, easy to operate instrument. It is used to measure electrical characteristics of circuits and circuit components. Accurate quantity measurements of D.C. and A.C. voltages, direct currents, resistances, decibels, and output voltages can be made.

One of the features of the 260-5 is the use of a high torque annular meter movement. The movement is self-shielded, eliminating errors caused by normally encountered currents and magnetic materials, and is also constructed with spring backed jewels to increase its resistance to possible shock and vibration damage.

A special calibration circuit is used to increase the initial accuracy of the tester and to facilitate recalibration in the event that this should ever be necessary.

The 260-5 uses the most modern components and circuit techniques. Assembly is done by well trained personnel using quality material and modern equipment. This combination of design, materials, and skillful assembly results in a unit that will take considerable abuse and still provide

## **General Description**

accurate indication. If it is kept clean and is not subjected to extreme shock or continuous vibration, the 260-5 will give many years of trouble free service.

### **PHYSICAL**

#### **FRONT PANEL**

The instrument has a large easy-to-read  $4\frac{1}{2}$ " meter at the top of the front panel. Below the meter are three operating controls and eight circuit jacks. All switch positions and circuit jacks are labeled with white lettering on black phenolic to insure long-time readability.

#### **RANGE SWITCH**

The range switch, in the center of the lower part of the front panel, has 12 positions. It may be turned in either direction to obtain any desired range and circuit position. There are six voltage ranges for D.C. and six for A.C., six ranges for direct current, and three resistance ranges.

#### **FUNCTION SWITCH**

The function switch is located at the left hand side of the lower part of the front panel. It has three positions:-D.C., + D.C., and A.C. When direct current, D.C. voltage, or resistance is to be measured, the function switch may be set at-D.C. or + D.C., depending on the polarity of current or voltage. Reversing the test lead connections without removing them from the circuit under test is accomplished by use of the function switch.

#### **ZERO OHMS**

The control at the lower right on the panel is marked ZERO

## General Description

OHMS. This variable resistance in the ohmmeter circuit is used to compensate for the aging of the internal batteries.

### CIRCUIT JACKS

There are eight jacks, two in each corner of the front panel. These are the connection points for the test leads. Plug the prods of the test leads into the proper jacks to obtain the the circuit and range desired for each application.

At the lower left are COMMON- and + jacks. These are the jacks that will be used most. Connect the black test lead to COMMON-for all circuits and ranges except 10 amperes D.C. Connect the red test lead to the + jack for all circuits and ranges except those designated by the other circuit jacks.

Across the top of the panel are jacks marked -10 A., OUTPUT, 50  $\mu$ AMPS, and + 10 A. For all audio frequency output voltage ranges, use the red test lead connected to the OUTPUT jack. For the 50 microampere or 250 millivolt D.C. range, use the red test lead connected to the 50  $\mu$ AMPS jack. For the 10 ampere D.C. range, use the black test lead in the - 10 A. jack and the red test lead in the + 10 A. jack.

### PHENOLIC CASE

The phenolic case, designed and molded with heavy reinforced walls for maximum durability, provides exceptional maximum protection for the circuit components it houses.

### PRINTED CIRCUIT

Conforming to the latest engineering developments, most of the component parts are mounted in a printed circuit. This

## **General Description**

simplifies assembly, reduces maintenance, and extends the useful life of the instrument.

### **ADJUST-A-VUE HANDLE**

The comfortable handle is attached on each side of the instrument case. The handle may be used to support the instrument in a convenient, sloping position for easy viewing on the bench top. Of course, it can also be placed in either a vertical or horizontal position.

### **TEST LEADS**

Each instrument is furnished with one pair of four-foot test leads. One lead is black and the other red for easy polarity identification. The wire is very finely stranded and extra-flexible. Its insulation is a special high-grade rubber which has far more insulation strength than the largest voltage to which your instrument will ever be subjected.

### **TEST LEAD INSPECTION**

Periodic inspection of the test leads is recommended to detect cuts, burns or other damage that could reduce the insulation strength of the leads. When replacement is indicated, ask your local distributor for catalog number 7500.

### **FUSE PROTECTION**

A fuse is provided to protect the tester circuits from misuse on the ohmmeter ranges and from excessive overloads on the milliampere ranges.

### **OVERLOAD PROTECTION**

Your 260 has been designed to minimize the possibility of

## General Description

accidental damage due to overloads. Specially produced diodes protect the movement from burn-out or mechanical damage such as bent pointer even with 1000 times the normal current applied.

In addition a fuse is provided to help protect the circuitry from damage due to overloads. This protective combination will prevent serious damage to your 260 in most cases of accidental misuse. However, no overload protection system is completely foolproof, and misapplication on high voltage circuits can damage any VOM protected or not. Care and caution should always be exercised to protect both you and your 260.

## SIZE AND WEIGHT

The 260 measures 5-1/4" by 7" by 3-1/8". It weighs 3 pounds.

## ELECTRICAL

### MEASUREMENT RANGES

#### D.C. VOLTAGE

Accuracy in % of F.S.

Sensitivity; 20,000 ohms-per-volt

0- 250	Millivolts	2%
0- 2.5	volts	2%
0- 10	volts	2%
0- 50	volts	2%
0- 250	volts	2%
0-1000	volts	2%
0-5000	volts	3%

## General Description

### A.C. VOLTAGE Accuracy in % of F.S.

Sensitivity; 5,000 ohms-per-volt

0-	2.5	volts	3%
0-	10	volts	3%
0-	50	volts	3%
0-	250	volts	3%
0-1000	volts		3%
0-5000	volts		4%

### DIRECT CURRENT Accuracy in % of F.S.

0-	50	microamperes	1.5%
0-	1	milliampere	2%
0-	10	milliamperes	2%
0-	100	milliamperes	2%
0-	500	milliamperes	2%
0-	10	amperes	2%

### D.C. RESISTANCE Accuracy in degrees of ARC

R x 1 for 0-2000 ohms (12 ohms center)	2.5°
R x 100 for 0-200,000 ohms (1200 ohms center)	2.0°
R x 10,000 for 0-20 megohms (120,000 ohms center)	2.0°

### A.F. OUTPUT VOLTAGE

With 0.1  $\mu$ f internal series capacitor

0-	2.5	volts
0-	10	volts
0-	50	volts
0-	250	volts

## General Description

### VOLUME LEVEL IN DECIBELS

With zero DB equal to 1 milliwatt across a 600 ohm line

- 20 to +10 DB
- 8 to +22 DB
- + 6 to +36 DB
- +20 to +50 DB

### INTERNAL BATTERIES

There are five 1.5 volt batteries inside the instrument. These are used for the ohmmeter circuits. One large cell is used to furnish 1.5 volts for the R x 1 and R x 100 ranges. Four smaller cells are added in series to furnish 7.5 volts for the R x 10,000 range.

Each battery is held in place with two special spring clips, which also serve as battery contacts. The polarity symbols are marked on the panel. Always observe polarity when you replace the batteries in the instrument.

### FREQUENCY RESPONSE

The frequency response for A.C. voltage measurements is essentially "flat" through the range from 20 cycles per second up to 200,000 cycles per second.

## **SECTION II**

### **OPERATING INSTRUCTIONS**

#### **CAUTION**

When making voltage or current measurements, as a personal protection, form the habit of turning off all power to the circuit under test. Connect the test leads at the desired points in the circuit. Then turn on the power while taking readings. Turn off the power before disconnecting the test leads from the circuit.

#### **ADJUST POINTER FOR ZERO**

Before any measurements are made, check to see that the pointer indicates zero when the meter is in its operating position. If the pointer is off zero, adjust the screw located in the phenolic case below the center of the meter scale, as shown in Figure 1. Use a small screwdriver to turn this screw slowly clockwise or counterclockwise until the pointer is exactly over the zero mark at the left side of the scale.

#### **D.C. VOLTAGE MEASUREMENTS, 0-250 MILLIVOLT RANGE ONLY**

#### **CAUTION**

Care should be taken when using the instrument as a millivoltmeter to prevent damage to the meter. An excessive voltage applied to the meter when in this type of application could be detrimental to the meter movement.

## Operating Instructions

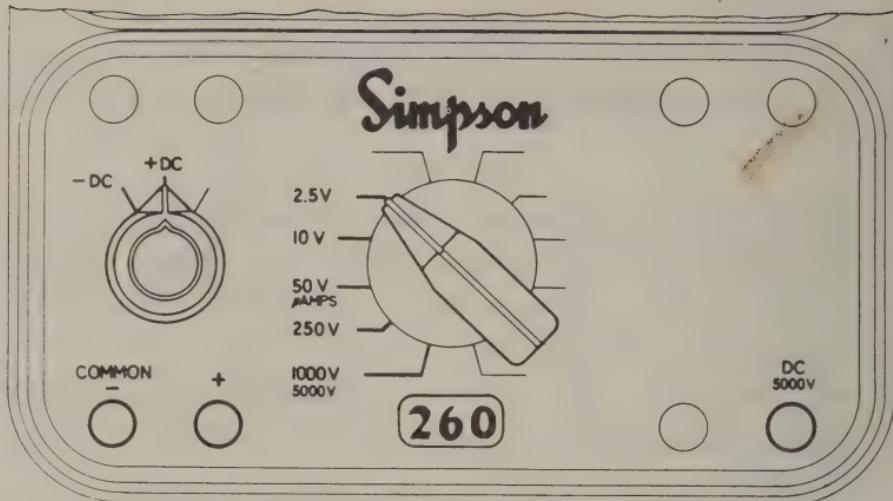


FIG. 3. JACKS AND SWITCH POSITIONS FOR D.C. VOLTS

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON-jack and the red test lead in the  $50\mu\text{AMPS}$  jacks.
3. Set the range switch at  $50\mu\text{AMPS}$  (common position with 50V.).
4. Connect the black test lead to the negative side of the circuit to be measured, and the red test lead to the positive side of the circuit.
5. Read the voltage on the black arc marked D.C., and use the figures marked 0-250; read directly in millivolts.
6. Turn off power in the circuit which is being measured before disconnecting meter leads.

### D.C. VOLTAGE MEASUREMENTS, 0-1000 VOLTS

1. Set the function switch on the left hand side of the front panel at + D.C.

## Operating Instructions

2. Plug the black test lead into the COMMON-jack and the red test lead into the + jack.
3. Set the range selector switch in any of the five voltage range positions. These are marked 2.5V., 10 V., 50 V., 250 V., and 1000 V. When in doubt as to the voltage present, always use the highest voltage range as a protection to the instrument. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.
4. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.
5. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit which is being tested. Set the function switch at -D.C., and turn on the power again. This will correct the polarity as applied to the meter.
6. Read the voltage on the black arc marked D.C. which is second from the top of the dial.  
For the 2.5 V. range use the 0-250 figures and divide by 100.  
For the 10 V., 50 V., and 250 V. ranges read the figures and multiply by 100.
7. Turn off the power in the circuit which is being measured before disconnecting meter leads.

### D. C. VOLTAGE MEASUREMENTS, 5000 VOLT RANGE WARNING

Be extremely careful when working in high voltage cir-

## Operating Instructions

cuits. Do not touch the meter or test leads while power is on in the circuit being measured.

1. Set the function switch at + D.C.
2. Set the range selector switch at 5000 V.
3. Connect the black test lead into the COMMON-jack and the red test lead into the D.C. 5000 V. Jack.
4. Be sure power is off in the circuit to be measured and all capacitors have been discharged: connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.
5. Turn on the power in the circuit. Do not touch the meter or test leads. If the pointer deflects to the left side of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit being tested. Set the function switch at -D.C., and turn on the power again. This will correct the polarity as applied to the meter.
6. Read the voltage using the 0-50 figures on the black arc which is second from the top of the scale. Multiply the reading by 100.
7. Turn off the power before disconnecting the test leads.

NOTE: To measure higher D.C. Voltage, see section IV for high voltage accessory probes.

## MEASURING A.C. VOLTAGE TO 1000 VOLTS

The Simpson 260 measures A.C. voltage in terms of the R.M.S. value of a sine wave. This is accomplished by using two germanium diodes in a modified full-wave bridge circuit.

1. Set the function switch at A.C.
2. Set the range selector switch in any of the five voltage range positions, marked 2.5 V., 10 V., 50 V., 250 V.,

## Operating Instructions

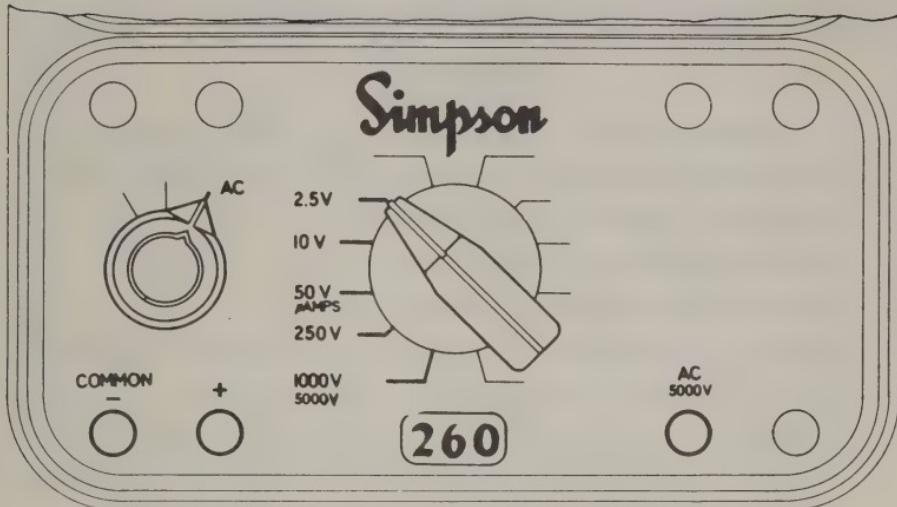


FIG. 4. JACKS AND SWITCH POSITIONS FOR A.C. VOLTS

and 1000 V. When in doubt as to the voltage present, always use the highest voltage range as a protection to the instrument. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.

3. Plug the black test lead into the COMMON-jack and the red test lead into the + jack.
4. Be sure power is turned off in the circuit to be measured and connect the test leads across the voltage source.
5. Turn on the power in the circuit to be measured.

For the 0-2.5 V. range read the value directly on the special arc marked 2.5 V.A.C. ONLY.

For the 10 V., 50 V., and 250 V. ranges read the red arc marked A.C. and use the black figures immediately above the arc.

For the 1000 V. range read the red arc marked A.C. Use the 0-10 figures and multiply by 100.

## Operating Instructions

### MEASURING A.C. VOLTAGE TO 5000 VOLTS

#### WARNING

Be extremely careful when working in high voltage circuits. Do not touch the meter or test leads while power is on in the circuit being measured.

1. Set the function switch at A.C.
2. Set the range selector switch at 5000 V.
3. Connect the black test lead into the COMMON-jack and the red test lead into the A.C. 5000 V. jack.
4. Be sure the power is off in the circuit to be measured and that all its capacitors have been discharged. Connect the test leads into the circuit.
5. Turn on the power in the circuit to be measured. Do not touch the meter or test leads.
6. Read the voltage on the red arc marked A.C. Use the 0-50 figures and multiply by 100.
7. Turn off the power before disconnecting the test leads.

### MEASURING OUTPUT VOLTAGES

An output voltage is the A.C. component only, when there is a mixture of A.C. and D.C. voltages. This occurs mostly in amplifier circuits.

The tester has a capacitor in series with the OUTPUT jack. This blocks the D.C. component of the current in the measuring circuit, but allows the A.C. or desired component to pass on to the meter circuit. The blocking capacitor placed in series with the A.C. voltage measuring circuits alters the A.C. response.

1. Set the function switch on the left hand side of the front panel at A.C.

# Operating Instructions

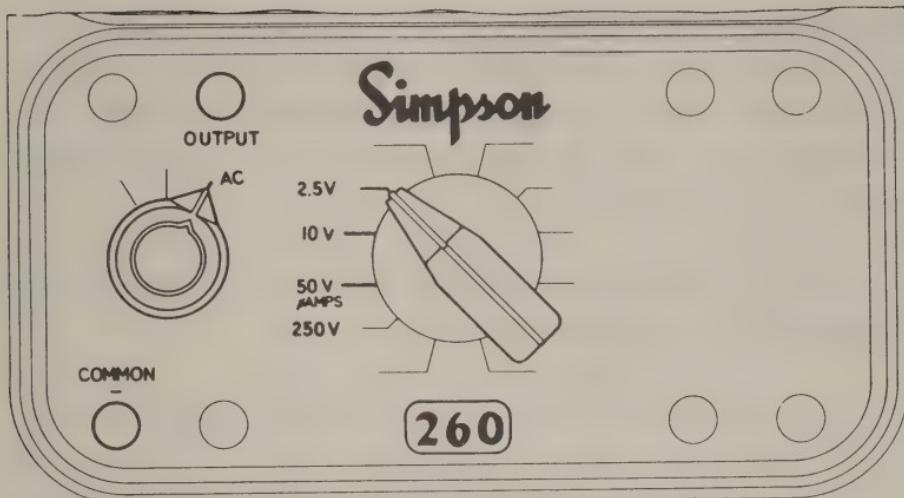


FIG. 5. JACKS AND SWITCH POSITIONS FOR OUTPUT

2. Connect the black test lead in the COMMON-jack and the red test lead in the OUTPUT jack.
3. Set the range selector switch at the desired range position. These are marked 2.5 V., 10 V., 50 V., and 250 V.
4. Connect the black test lead to the grounded side of the circuit to be measured and the red test lead to the "hot" side.
5. Turn on the power in the circuit. Read the output voltage on the A.C. voltage arcs of the dial.  
For the 0-2.5 V. range read the value directly on the special arc marked 2.5 V.A.C. ONLY.  
For the 10 V., 50 V., and 250 V. ranges use the red arc marked A.C. and read the black figures immediately above the arc.
6. Turn off the power in the circuit before disconnecting the leads.

## Operating Instructions

### MEASURING DECIBELS

For some applications, output voltage and audio frequency voltage are frequently measured in terms of decibels. The decibel scale (DB), at the bottom of the dial is numbered from -20 through 0 to +10.

To measure decibels, read the DB arc after proceeding according to instructions for A.C.

The DB readings obtained will be correct on an absolute scale if you are using a 0 DB power level of .001 watt in 600 ohms, and if the voltage which you read was measured across 600 ohms.

To obtain absolute DB values across 600 ohms:

For the 10 V. range read the DB arc and add +12 DB to the reading.

For the 50 V. range read the DB arc and add +26 DB to the reading.

For the 250 V. range read the DB arc and add +40 DB to the reading.

If the reference level is 0 DB = .006 watt in 500 ohms, subtract (+) 7 DB from the reading to obtain the absolute value of decibels.

### OHMMETER CIRCUIT

When resistances are measured in ohms, the batteries inside the case furnish power for the circuit. Since the batteries are subject to deterioration over long periods of time there is a compensating circuit in the ohmmeter to make it possible to extend the useful life of the batteries.

# Operating Instructions

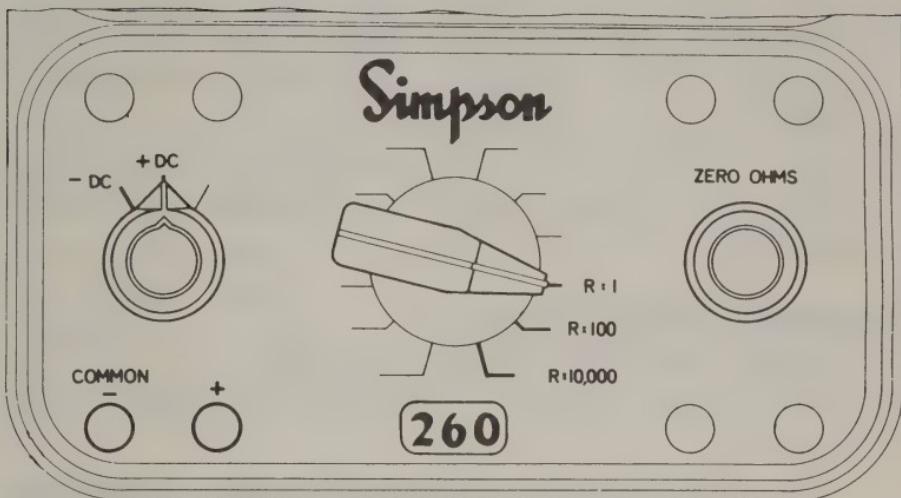


FIG. 6. JACKS AND SWITCH POSITIONS FOR RESISTANCES

## ZERO OHMS ADJUST

Each time you use the ohmmeter circuit, check the zero indication on the meter before you measure any resistance. Check and adjust it each time you switch to a different range. To set the ZERO OHMS control, proceed as follows:

1. Set the range switch at one of the resistance range positions and the function switch at either—D.C. or +D.C.
2. Connect the black test lead in the COMMON—jack and the red test lead in the + jack.
3. Clip the contact end of the test leads together to short out the resistance circuit.
4. Observe the meter indication. It should read 0 on the right hand end of the OHMS arc, which is at the top of the dial.
5. If the pointer does not read 0, rotate the ZERO OHMS

## Operating Instructions

knob until it does. If you cannot bring the pointer far enough to read 0, one or more batteries need to be replaced.

6. When the pointer shows zero, unclip the shorted test leads; the ohmmeter circuit is now ready to measure resistance.

### MEASURING RESISTANCES

To measure resistance, proceed as follows:

1. Set the range switch in one of the resistance range positions.
  - Use R x 1 for resistance readings from 0 to 200 ohms.
  - Use R x 100 for resistance readings from 200 to 20,000 ohms.
  - Use R x 10,000 for resistance readings above 20,000 ohms.
2. Set the function switch at either—D.C. or + D.C.
3. Connect the black test lead in the COMMON—jack and the red test lead in the + jack.
4. Short the test leads together and adjust for zero ohms (see instructions above).
5. Separate the test leads and connect them across the resistance which is to be measured. If there is a "forward" and "backward" resistance such as in rectifiers, switch back and forth between the two D.C. positions of the function switch to reverse this polarity.

#### NOTE

The resistance of such rectifiers will measure different values on different resistance ranges.

## Operating Instructions

A crystal diode which measures 80 ohms, for example, on the R x 1 range may measure 300 ohms on the R x 100 range. This is normal, and is a result of the diode characteristic. The difference in values does not indicate any fault in the ohmmeter.

6. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values.
7. Multiply the reading by the multiplier factor at the switch position for the resistance value in ohms. "K" on the dial stands for "thousand".

## MEASURING DIRECT CURRENTS, 0 TO 50 MICROAMPERES

### CAUTION

Never connect the test leads directly across any voltage when the 260 is used as a current meter, except when it is used as a 0-250 millivoltmeter. This would damage the instrument. Always connect the meter in series with the load across the voltage source.

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON-jack and the red test lead in the 50  $\mu$ AMPS jack.
3. Set the range switch at 50  $\mu$ AMPS (common position with 50 V.).
4. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side, and the black test lead toward the negative side.
5. Turn on the power in the circuit which is to be measured.

## Operating Instructions

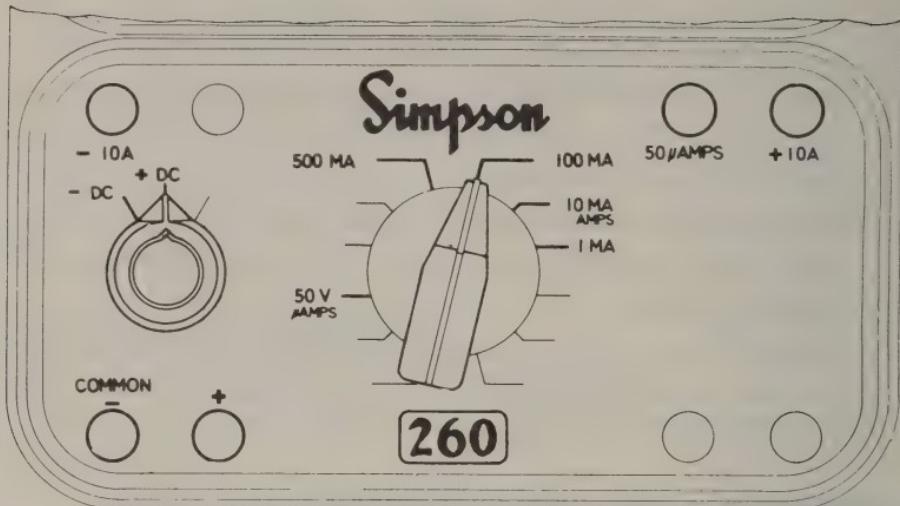


FIG. 7. JACKS AND SWITCH POSITIONS FOR DIRECT CURRENTS

Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power and reverse leads.

6. Read the current directly on the black D.C. arc. Use the 0-50 figures. The current value is shown in microamperes.
7. Turn off the circuit power. Remove the test leads and restore the circuit continuity.

### MEASURING DIRECT CURRENTS, 0 TO 500 MILLIAMPERES

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON-jack and the red test lead in the + jack.
3. Set the range switch in any of the four range positions required. These are marked 1 MA., 10 MA., 100 MA.,

## Operating Instructions

and 500 MA.

4. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.
5. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, set the function switch at -D.C. and then turn on the power again.
6. Read the current directly on the black D.C. arc.  
For the 1 MA. range use the 0-10 figures and divide by 10.  
For the 10 MA. range use the 0-10 figures directly.  
For the 100 MA. range read the 0-10 figures and multiply by 10.  
For the 500 MA. range read the 0-50 figures and multiply by 10.  
The current values are in milliamperes.
7. Turn off the circuit power. Remove the test leads and restore circuit continuity.

### MEASURING DIRECT CURRENTS, 0 TO 10 AMPERES

1. Connect the black test lead in the -10 A. jack and the red test lead in the +10 A. jack.
2. Set the range selector switch at 10 AMPS (common with 10 MA.).
3. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test

## Maintenance

lead toward the positive side and the black test lead the negative side.

4. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left the current polarity is opposite to that which was anticipated. Turn off the power, reverse the test lead connections, and turn on the power again.

### NOTE

The function switch has no effect on polarity for the 10 AMP range.

5. Read the current directly on the black D.C. arc. Use the 0-10 figures. The current values are in amperes.
6. Turn off the circuit power. Remove the test leads and restore circuit continuity.

## SECTION III MAINTENANCE

### HOW TO OPEN THE CASE

To open the case use a  $\frac{1}{4}$ -inch screwdriver to remove the four screws through the bottom of the case. Then slip the entire front panel straight forward out of the case. The meter, the front panel, the printed circuit, and the batteries are all attached together and will come out as a unit.

### BATTERY REPLACEMENT

There are five batteries inside the case behind the front panel. They are used to supply power for resistance measurements. One is a large size (#2, Size D) flashlight cell, and the other four are smaller (#Z) flashlight cells. When it is no

## Maintenance

longer possible to bring the pointer to 0 for the R x 1 and R x 100 ranges (see ZERO OHMS ADJUST, page 19), replace the large cell with a fresh one. When it is no longer possible to bring the pointer to 0 on the R x 10,000 range, replace the four smaller cells with fresh ones. This will restore operation of the ohmmeter circuit.

**NOTE:** When batteries reach the end of their useful life, they should be replaced promptly. Failure to do so may result in extensive damage to your tester, due to battery leakage, even though the battery may be labeled "Leakproof."

## OBSERVE POLARITY

When you replace the cells, be sure to observe the polarity of the battery circuit. The cells are held each in place with specially designed spring clips which also act as battery contacts. Battery polarity is shown on the panel.

## RECTIFIER REPLACEMENT AND RECALIBRATION

There are two small rectifiers which are located at the top of the printed circuit, near the large 1.5 volt cell. These are used to rectify the A.C. voltages for measurement. They are shown as D-1 and D-2 in the overall schematic diagram, Fig. 8.

Both rectifiers act in the meter circuit to effectively create a full wave rectifying action. If either or both should fail, the meter will show incorrect indications.

## Maintenance

In case of rectifier failure, replace the defective rectifier with another 1N87G, and be sure to observe polarity when you connect it into the circuit. If a type 1N87G is not available use any good quality small crystal rectifier as a replacement.

After you replace either or both rectifiers, test the accuracy of A.C. voltage indications. If necessary, recalibrate the circuit by adjusting rheostats R-28 and R-31 as follows:

1. Set the function switch at A.C. and the range switch at 250 V.
2. Connect the red test lead in the + jack and the black test lead in the COMMON - jack.
3. From a standard voltage source, apply 250 volts A.C. to the red and black test leads. Adjust rheostat R-31 (located at the upper right hand corner of the printed circuit board viewed from rear of the instrument) so the meter reads full scale. Turn power off.
4. Set the range switch to 2.5 V. Apply 2.5 volts A.C. to the red and black test leads. Adjust rheostat R-28 (located at the upper left hand portion of the printed circuit board), so the meter reads full scale.
5. Turn power off.

If no standard voltage supply is available for the above procedure, use this alternate method:

1. Set the function switch at A.C., and the range switch at 2.5 V.
2. Connect the red test lead in the + jack and the black test lead in the COMMON - jack.

## Maintenance

3. Connect the test leads to a fresh 1.5 volt flashlight cell. Connect the red test lead to the positive post of the battery and the black test lead to the negative post.
4. Adjust rheostat R-28 fully clockwise.
5. Adjust R-31 so the meter reads 1.8 volts on the 2.5 V.A.C. ONLY arc.
6. Adjust R-28 so the meter pointer moves back to 1.71 volts on the same arc.

### **RESISTOR REPLACEMENT**

Almost all of the resistors are mounted on the rear of the printed circuit. This makes them easily accessible for trouble-shooting and repair.

When it is necessary to replace any of the resistors in the circuit, first obtain an exact equivalent resistor. Order it from your nearest Simpson Parts Depot (see page 35) and specify the Simpson part number as it is shown in the parts list. Then clip the defective resistor off the printed circuit board, leaving the leads in the board to use as connections for the replacement.

Carefully twist the leads for the new resistor around the leads left from the defective resistor, and solder each connection. Trim away all excess and see that you have not caused any short circuit to any other part nearby.

### **REMOVING THE PRINTED CIRCUIT**

When you require access to the under-side of the printed circuit, or to the parts which are located between it and the

## Maintenance

front panel, remove the printed circuit.

To remove the printed circuit, use the following procedure:

1. Set the function switch at + D.C. and the range switch at 2.5 V.
2. Remove the knob for the ZERO OHMS control.
3. Remove the two screws through the lower part of the printed circuit board.
4. Remove the two hex nuts from the meter studs on the top of the printed circuit board.
5. Carefully pry out the battery contact at the + terminal for the small 1.5 volt cells, and the -terminal for the large 1.5 volt cell.
6. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.
7. After removal do not turn knobs on front panel or move any rotors on switches until reassembled.

## FUSE REPLACEMENT

Remove the front panel from the case and disconnect the burned-out fuse, using a small (60-watt or less) soldering iron. Replace with a 1 amp, 250 volt pigtail fuse, type 3AG or equivalent only.

## Maintenance

## PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 1138 ohms	1-113372
R2	Resistor, 110 ohms	1-113373
R3	Resistor, 21,850 ohms	1-113369
R4	Resistor, 117,700 ohms	1-113367
R5	Resistor, 238 ohms	1-115897
R6	Resistor, 37,500 ohms	1-113393
R7	Resistor, 200,000 ohms	1-113365
R8	Resistor, 800,000 ohms	1-113363
R9	Resistor, 3.75 megohms	1-115765
R10	Resistor, 45,000 ohms	1-114192
R12	Resistor, 150,000 ohms	1-113366
R13	Resistor, 1 megohm	1-113392
R14	Resistor, 4 megohms	1-113362
R15	Resistor, 15 megohms	1-115763
R16	Resistor, 11.2 ohms (bobbin)	10-805073
R17	Resistor, 0.468 ohm (bobbin)	10-675254
R18	Resistor, 22.5 ohms (bobbin)	0-008133
R19	Resistor, 2 ohms (bobbin)	0-008060
R20	Resistor, 80 megohms	1-113353
R21	Resistor, 20.2 megohms	1-116491
R22	Resistor, .025 Shunt Assy. 10 amp	0-007093
R25	Potentiometer, 10,000 ohms $\pm 30\%$	5-110295
R26	Resistor, 7500 ohms	1-113370
R27	Rheostat, 5K ohms $\pm 10\%$	1-116254
R28	Rheostat, 5K ohms $\pm 10\%$	1-116254
R29	Resistor, 5000 ohms	1-113425

Reference Symbol	Description	Simpson Part No.
R30	Resistor, 5000 ohms	1-113425
R31	Rheostat, 5K ohms $\pm 10\%$	1-116254
R32	Potentiometer, 200K $\Omega \pm 20\%$	1-110193
C1	Capacitor, 0.1 $\mu f$ , 400 v.	1-113733
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
D3	Varistor, Silicon	1-110670
	Test lead set (one red and one black)	7500
	Phenolic case	3-320141
	Carrying handle	1-115316
	Knobs	
	For function switch	1-115789
	For Range switch (less set screw)	3-260180
	Set Screw (for knob 3-260180)	1-114178
	For Zero Ohms Adjust	1-115790
F1	Fuse, 1 amp, 250 volt, pigtail type 3AG or equivalent	1-117702
260-5M	Meter Assembly	15-302260-5M
260-5	Meter Assembly	15-302260-5

## SECTION IV APPLICATIONS

### GENERAL

The Simpson Volt-Ohm-Milliammeter 260, Series 5, is designed to measure almost all characteristics of electrical and electronic circuits. It is the most versatile piece of test equipment that you can own.

POSITION #1 OF THIS SECTION  
IS CONTACT ARM

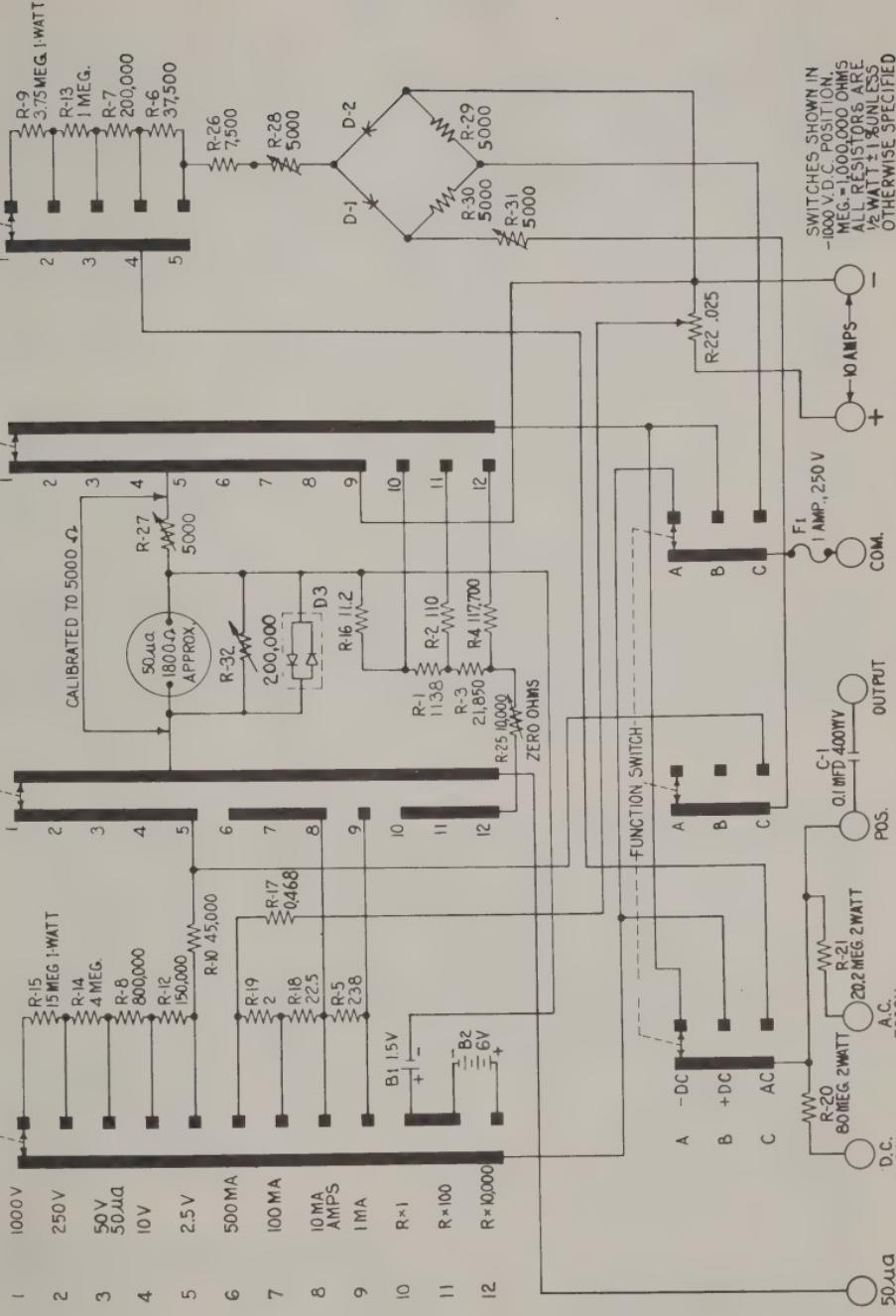


FIG. 8. OVERALL SCHEMATIC. SIMPSON VOLT-OHM-MILLIAMMETER, 260 SERIES 5 & SERIES 5M

## Applications

In D.C. circuits, it will measure the voltage, the current, and the resistance. The measurements are made, through a very wide and common range, in terms of ordinary units for all values. Although the upper limit for D.C. voltage is 5000 volts, Simpson makes accessory multiplier probes to extend the range to 25,000 and 50,000 volts! By way of contrast, direct currents as small as 1 microampere can be read on the 50 microampere D.C. range.

For A.C. voltage measurements, the values are shown in terms of either R.M.S. volts on the basis of full wave rectification, or of decibels. The decible ranges are based on the common arbitrary zero level of 1 milliwatt in 600 ohms. Both portions of mixed A.C. and D.C. voltages can be read. The output circuit measures the A.C. portion, and the D.C. portion is indicated directly with the D.C. voltage circuit.

## FORWARD AND REVERSE RECTIFIER RESISTANCES

The resistance of copper oxide, selenium, and crystal rectifiers can normally be measured in both directions. However, the resistance should be quite small in one direction (for forward polarity) and very large in the opposite direction. Use the ohmmeter circuit to determine that there is a large difference between the resistances in the two directions.

## SIMPLE CAPACITOR CHECKS

The ohmmeter circuit can be used to identify good, open, and short conditions for many capacitors. Use the  $R \times 10,000$  range for best results.

## **Applications**

A good capacitor will allow current to flow, deflecting the meter pointer, while it is charging up to the applied voltage. This produces a swing on the meter, with a gradual return of the pointer to infinity at the left hand side of the scale. The greater the capacity, the more the pointer will swing and the longer it will take for it to return to infinity.

If the capacitor is open, there will be no pointer deflection at the beginning of this test. Note that very small capacitors will have only a very slight deflection and a rapid return to infinity. Watch the meter closely when you test small capacitors.

If the capacitor is shorted, the pointer will not return to infinity. So when the pointer remains deflected on the ohms scale, and does not return, even slowly, this probably indicates a short in the capacitor.

Always reconfirm the results of these simple tests with more conclusive test equipment, or by replacement checks.

## **ACCESSORY DC HIGH VOLTAGE PROBES**

### **DC HIGH VOLTAGE TEST PROBES**

**(20,000 OHMS PER VOLT)**

<b>PART NO. 0507</b>	<b>10,000 Volts DC</b>
<b>PART NO. 0508</b>	<b>25,000 Volts DC</b>
<b>PART NO. 0509</b>	<b>50,000 Volts DC</b>

## **GENERAL DESCRIPTION**

The DC high voltage probes extend the range of a 20,000 ohms per volt multimeter in a safe, convenient manner at

## Applications

nominal cost. Their primary purpose is the measurement of terminal potentials of very high voltage, very low power capacity direct current sources, example of which are anode supplies used in television receivers and other cathode ray tube type circuitry.

The probe body is made of high temperature polystyrene in order to provide high dielectric strength and low leakage. It contains a high megohm precision resistor.

A shielded cable and internal probe shield is used to protect the operator from any possible flash-over and to ground any electrostatic charges that might accumulate on the probe body.

The internal shield and cable shield are connected to the ground return lead by a flexible copper braid between the two elbow connectors. A 48 inch ground return lead with an insulated clip completes the test lead set. No additional wires are needed.

## ELECTRICAL SPECIFICATIONS

These D.C. high voltage probes are designed for use with the Simpson 260, Series 5 or any 20,000 ohms per volt tester having a 2.5 volt D.C. range and scale graduations from 0-10 or multiple thereof for the 10 KV probe, 0-25 or multiple thereof for the 25 KV probe, and 0-50 or multiple thereof the 50 KV probe.

### Accuracy:

Probe Resistance  $\pm 2\%$ .

The DC high voltage test probes are available at your local electronics parts distributor.

## SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

Arizona, Phoenix 85034 Metermaster/Phoenix 2633 E. Buckeye Road	Area Code 602 273-7331
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California, Los Angeles 90007 Quality Electric Division of Kierulff Elec., Inc. 3700 South Broadway	Area Code 213 232-3501
California, Mountain View 94041 Kierulff/Metermaster 2484 Middlefield Road	Area Code 415 968-6292
California, San Diego 92111 Metermaster/San Diego 8137 Engineer Road	Area Code 714 276-5202
California, San Francisco 94105 Pacific Electrical Instrument Lab. 111 Main Street	Area Code 415 421-7185
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Colorado, Denver 80209 Metermaster Instrument Corporation 748 So. Broadway	Area Code 303 722-8462
Connecticut, Middletown Mancib Company Randolph Road—PO Box 467	Area Code 203 Diamond 7-5629

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Florida, Miami 33136 Florida Precision Instrument Corp. 800 N.W. 7th Avenue	Area Code 305 374-1731
Florida, Orlando 32806 Electro Tech Inc. 307 - 27th Street	Area Code 305 423-5589
Georgia, Hapeville 30054 Electro-Tech, Inc. 3020 Commerce Way	Area Code 404 758-7205
Hawaii, Honolulu 96817 Electronic Systems Inc. 1622-26 Silva Street	851-457 811-132
Illinois, Chicago 60625 (Niles) A & M Instrument, Incorporated 7800 N. Merrimac	Area Code 312 966-8100
Illinois, Chicago 60644 Pacific Indicator Company 5924 W. Madison Street	Area Code 312 261-1330
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Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621
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Massachusetts, Cambridge 02138 A. S. Mancib 363 Walden Street	Area Code 617 864-2494
Massachusetts, Needham Heights 02194 Instruments, Incorporated 570 Hillside Avenue	Area Code 617 444-9410

Michigan, Detroit 48220 Ram Meter, Inc. 1100 Hilton Road Ferndale	Area Code 313 547-1000
Minnesota, Minneapolis 55411 Instrumentation Services Inc. 917 Plymouth Avenue	Area Code 612 521-8803
Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 367-9800
New Jersey, Belleville 07109 Marshall Instruments, Inc. 236 Washington Avenue	Area Code 201 751-1190
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it takes...  
for many tests



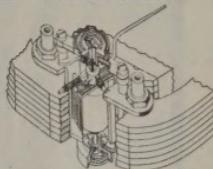
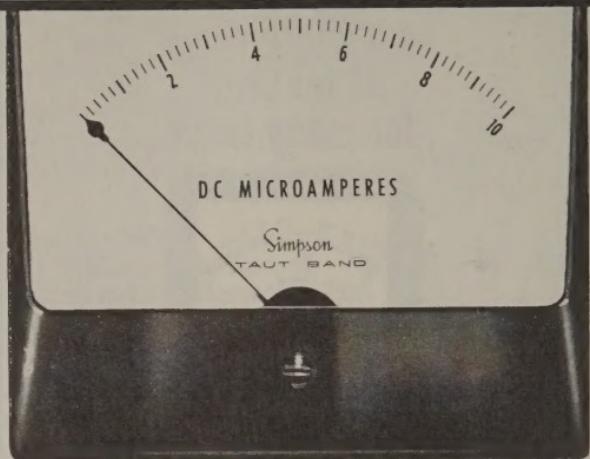
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AC/DC VOLT-OHM-MILLIAMMETER: 14 ranges.....	Model 240	40.00
OHMMETER: 6 ranges, 0 ohms to 50 meg.....	Model 372	35.00
LOW-OHMMETER: 0-5, 0-25 ohms.....	Model 362	35.00
AC AMMETER: 0-1, 2.5, 5, 10, 25 amp, $\pm 5\%$ FS.....	Model 370	35.00
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AC MILLIAMMETER: 0-5, 25, 100, 250, 1000 ma, $\pm 5\%$ FS.....	Model 378	35.00
DC MILLIAMMETER: 0-1, 5, 10, 25, 50, 100, 250, 1000 ma, $\pm 3\%$ FS.....	Model 373	35.00
DC MICROAMMETER: 0-50, 100, 250, 500, 1000, ua $\pm 3\%$ FS.....	Model 374	35.00
AC VOLTMETER: 0-5, 10, 25, 50, 100, 250, 500, 1000 v, $\pm 5\%$ FS.....	Model 376	35.00
AC VOLTMETER: 0-150, 300, 600 v, $\pm 3\%$ FS.....	Model 371	35.00
DC VOLTMETER: 10 ranges, 0 to 1000 v, $\pm 3\%$ FS.....	Model 377	35.00
DC MILLIVOLTMETER: 0-10, 30, 100, 300, 1000 mv, $\pm 3\%$ FS.....	Model 387	35.00
AC VOLT-AMP-WATTMETER: 8 ranges (300 v, 15 a, 3000 w, max) $\pm 5\%$ FS .....	Model 390	60.00
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## **WARRANTY**

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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